

130F-1

SHARPENING HAND TOOLS, RECONDITIONING, AND GRINDER SAFETY

AG 130-F

UNIT OBJECTIVE

After completion of this unit, students will be able to sharpen tools and know how to use bench grinders safely. This knowledge will be demonstrated by completion of assignment sheets and a unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Sharpen selected cutting tools correctly, including chisels, screwdrivers, twist drills, blades, hoes, axes, knives, scissors, and shears.
2. Proper use, set-up, and selection of grinding wheels for bench grinders.
3. Proper use of draw file and file card

## SHARPENING HAND TOOLS AND GRINDER SAFETY

### A. Hand Sharpening Tools Safety

1. Files, rasps, and whetstones are used to sharpen a variety of shop tools.  
(Much of this information has been presented in previous units, but a review can be of great importance due to the danger of the equipment in use.)
2. Unskilled and/or careless use of files and rasps causes numerous injuries while sharpening tools.
  - a. Never use a file or a rasp without a handle. The pointed end can puncture or lacerate the skin.
  - b. Always use two hands while filing. This prevents the tool from bouncing off the work material and onto the worker. The flat edges of the file or rasp are sharp enough to cut skin.
  - c. Use the file in one direction only. File away from the body to prevent injury. The teeth of the file are generally facing one direction. To file against the teeth will cause the file to bounce off the work material and injure the worker.
3. Whetstones are used to sharpen knives, scissors, and other flat-bladed tools.
  - a. Always keep hands and fingers clear of the area of the stone where the tool is being sharpened.
  - b. Secure the whetstone before sharpening a tool in order to prevent slippage.

### B. Grinder Safety

1. A grinder is a piece of power equipment used to abrasively remove metal from a larger piece of material.
2. Two types of grinders are commonly found in the shop.
  - a. A bench grinder is larger in size and must be securely mounted to a table or bench.
  - b. A portable hand grinder can be used anywhere that an electrical source is available.
3. There are many specific safety practices regarding grinders.
  - a. All guards and safety devices must be in place and be operable before using. These devices include shields and eye shields.

- b. The tool rest on the bench grinder must be in proper adjustment at all times.
- c. Inspect the grinding wheel for grooves, cracks, or chips before operating.
- d. Always wear personal eye protection when operating a grinder. Never rely on the eye shields on the grinder alone.
- e. Never wear gloves, neckties, or loose-fitting clothing while operating any power equipment.
- f. Cool the tip of the material being ground often. This prevents a weakening of the metal and possible breaking of the tool.
- g. Never stand directly in front of the grinding wheel as it is coming to speed. A loose-fitting or unbalanced wheel may fly from the assembly and cause serious injury.
- h. Keep the spark deflector in place and never more than 1/8" from the grinding wheel. A space of more than 1/8" allows metal to be pulled between the toolrest and the grinding wheel. This action may catch fingers, cause the metal to be thrown by the grinder, or break the grinding wheel or toolrest.
- i. Always grind on the face of the grinding wheel and never on the sides. Constant side pressure may cause the wheel to break.
- j. Always use two hands when using a portable grinder. The high speeds of the wheel can cause the grinder to fly off the metal and injure the worker.

**\*SAFETY IN TOOL FITTING\***

**A. Safety Practices for Fitting Tools:**

Tool fitting is defined as the sharpening, cleaning, redressing, and adjustment of tools so they can better do the work they were designed to do. The following general safety precautions should be observed when fitting tools. As these precautions deal with general tool-fitting applications, other more specific safety measures may need to be implemented when performing specialized tool-fitting jobs.

1. Use solvents and chemicals safely. All solvents and cleaning chemicals used in tool fitting should be handled and stored according to the manufacturers' directions. Use solvents and chemicals only in well-ventilated areas. When using many chemicals, you must wear rubber gloves.
2. Fasten or hold tools to be fitted securely. Hold the workpiece firmly when grinding, filing, or performing other reconditioning operation. Do not allow the workpiece to be thrown, dropped, or chipped while it is being fitted.

3. Use handles on files when tool fitting. File handles will prevent the tang from being gouged into the hand.
4. Wear approved eye protection. Industrial-quality eye protection should be worn at all times.
5. Avoid loose-fitting clothing when you are grinding. Do not wear long sleeves and loose-fitting clothing when you are using a grinder because they are cumbersome and could get caught on the grinder.
6. Gloves are recommended only when materials being handled will cause injury to the hands. Gloves are awkward; thus, they produce extra hazard, especially for the worker who is using a grinder.
7. When using the stationary grinder for tool fitting.
  - a) Keep the tool rest no more than 1/8" from the grinding wheel.
  - b) Sound the grinding when it is mounted for cracks and internal flaws.
  - c) When turning on the machine, stand to the side of the grinding wheel. Never stand in direct line with the grinding wheel while it is coming up to operating speed.
  - d) Keep the face of the grinding wheel true. Use a grinding wheel dresser to true the wheel and remove glaze from the wheel surface.
  - e) Keep grinder eye shields in place and clean at all times.
  - f) Keep the spark deflector in place and adjusted so it is never more than 1/8" from the grinding wheel.
  - g) Grind only on the face of the grinding wheel. Heavy side pressure may cause the grinding wheel to break and then strike the operator.
  - h) Replace the grinding wheel when it is worn to within half of its original diameter. The surface grinding speed of the wheel is reduced when the grinding wheel is worn, resulting in a rough grinding surface. It is also difficult on most grinders to keep the toolrest adjusted to within 1/8" of the grinding wheel when the wheel is worn to less than half of its original diameter. If the toolrest cannot be properly adjusted, a safety hazard exists. A space of more than 1/8" allows metal to be pulled between the toolrest and the grinding wheel. This action may catch fingers, cause the metal to be thrown by the grinder, or break the grinding wheel, toolrest, or both.
  - i) Use water to cool the tools being fitted. Frequent cooling prevents loss of temper from the tool and burns to the operator. Tools should be cooled enough to hold in your hand without burning before grinding is resumed.
  - j) Do not grind when other workers are near. A bump to someone grinding may cause serious accident.

- k) Never leave the grinder running unattended.
- l) Do not exceed the recommended speed (RPM) of the grinding wheel.
- m) Never modify a grinding wheel to run on an arbor shaft smaller than the smallest bushing provided with the grinding wheel.

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## GRINDER AND WHEEL SELECTION

### A. Introduction

1. A grinder wheel is a wheel made of abrasive grit that is bonded together with a special material to hold the wheel together at high RPMs. Consideration should be given to grinder size, wheel size, and material to be ground when selecting a grinder wheel.
2. Grinder wheels are sized according to a variety of factors:
  - a. Diameter - The diameter of a wheel to be selected is determined by the size of the grinder it is to be used on. Common grinding wheel diameters include 5," 6," 7," 8," 10," and 12" sizes.
  - b. Width - Grinder wheels come in a variety of widths depending on the grinder size and application.
  - c. Grit Number - The grit is determined by the size of the pore space between abrasive particles that make up the wheel. The grit number is determined by the material that is to be ground by the wheel. The smaller the grit number, the coarser or rougher the surface of the wheel. Grit numbers range from the number 8, which is very coarse, all the way up through 240, which is very fine.
  - d. Arbor Hole Size - The arbor hole is the hole in the center of the wheel that allows the wheel to be mounted on the grinder axle, or arbor. This hole size is determined by the diameter of the arbor on the grinder to be used. The wheel must fit properly or it may spin out of round and may shatter when used.
  - e. Bond - The bond is determined by the material used to hold the abrasives together. The types of bonds commonly used are: vitrified (V), silicate (S), resinoid (B), rubber (R), and metal (E). Most wheels are held together with a vitrified bond. Fine-edged tools are sharpened on wheels that are made of silicate bonds. Rubber and resinoid bonds are used in making disk grinding wheels and cut-off disks. Metal bond is used for making diamond grinding wheels because it is the strongest.

B. Grade Markings (see page 130F-xx)

1. Position 1, Kind of abrasive
  - a. Letter “A” indicates aluminum oxide abrasive.
  - b. Letter “C” indicates silicon carbide abrasive.
2. Position 2, Grain size
3. Position 3, Grade
  - a. Using all letters of the alphabet
  - b. “A” being the softest
  - c. “Z” being the hardest
4. Position 4, Structure – the spacing between the grains or density
  - a. Numbers ranging from 1 (very dense) to 15 (open)
  - b. Number 1 produces a fine finish
  - c. Number 15 produces a course finish
5. Position 5, Kind of bond – holding the wheel together
6. Position 6, Manufacturer’s record
  - a. Specific bond combinations
  - b. Types of reinforcement
  - c. Side treatments furnished

C. Dressing the Grinder Wheel

1. The purpose of dressing the grinder wheel is to insure that it rotates true, is free of grooves on the wheel face, and that the spaces between the abrasive particles do not load up with particles of the material being ground.
2. The dressing tool is a device that removes some of the abrasive particles on the face of the wheel to expose the fresh abrasives below. It is also used to remove grooves and foreign particles from the abrasive surface.
3. Squaring the wheel is important to insure that the wheel spins true. The face of the wheel must be square to the sides after dressing the wheel. This is checked with a square.
4. Truing the wheel is done while the wheel is being dressed so that the wheel is balanced and does not vibrate excessively. If the wheel is not trued, the high speed at which it turns may break the wheel apart.

ACTIVITY:

1. Set up grinders with safety problems and have students inspect them.
2. Identify all of the safety features on grinders and describe the function of each.
3. Set up graphic demonstrations in order to show the effects of improper safety practices. For example, show the effects of a glove or a piece of loose clothing getting caught in an improperly adjusted tool rest.
4. Have students demonstrate the safe use of hand sharpening tools and grinders while sharpening tools.
5. Form a small groove in the face of the grinder wheel to show the students what true is, and then, using a wheel dresser, demonstrate how to properly dress the wheel including removing the groove, squaring the wheel, and checking for true.
6. Give examples of different tools that need to be sharpened and have the students select the appropriate grinder wheel for the job.

TOOL SHARPENING PROCEDURES

A. Tool fitting is defined as the sharpening, cleaning, redressing, and adjustment of tools so they can better do the work they were designed to do.

B. There are several important reasons to fit tools:

1. Workers are able to produce more work safely and with less effort when tools of the trade are well-fitted. A dull axe will not cut into wood as well as a sharp axe, so extra labor is required to do the same amount of work. Since a dull axe does not catch the wood as well, it is more likely to bounce off the wood and injure the worker than a sharp axe. Even a dull axe will break the skin.
2. It is more economical to sharpen a dull tool than to buy a new one.

C. Tool Sharpening Procedures

1. A cold chisel is a hand tool used to cut metal.
  - a. There are several different tip shapes for cold chisels which require a variety of different sharpening techniques. Tip shapes include flat, diamond point, round nose, and cape.
  - b. To sharpen a flat chisel, use a template to correctly grind the beveled side of the chisel. The correct angle ranges from 60 to 75 degrees.
  - c. The cutting edge of the chisel is ground first to remove all chips and gaps. Use the thumb and forefinger to guide the chisel towards the grinder while using the tool rest for support.

- d. After the cutting edge has been cleared of rough edges, turn the chisel over and grind the edge to the appropriate angle. Stop and check the angle of the bevel often to prevent over grinding. Over grinding will decrease the strength of the chisel cutting edge.
- e. Cool the chisel with water often while grinding to prevent overheating and a loss of temper.
- f. Check the manufacturer's recommendations for the correct angle to use on a diamond point chisel. Round nose and cape pointed chisels require equal grinding on all sides.

2. Wood chisels are hollow ground to obtain a razor sharp tip.

- a. Wood chisels are sharpened on one side only to an angle of  $25^{\circ}$  -  $30^{\circ}$ . The angle can be determined with the use of a template or protractor head square.
- b. The first step is to grind the cutting edge to make it square and to remove all nicks.
- c. Grind the edge of the tool, while checking frequently for the correct angle.
- d. Put a fine edge on the chisel with the use of a whetstone.

3. Screwdriver tips often get worn or bent out of shape and must be fitted.

- a. Select a flat-head screw with a slot the same width as the screwdriver blade tip.
- b. Grind the tip square and remove all gaps and twists in the screwdriver blade. Apply light pressure to the blade while moving it back and forth across the grinding wheel.
- c. Turn the screwdriver frequently to keep both sides parallel.
- d. If ground correctly, the tip should fit completely into the screw slot with no gaps.

4. A twist drill is used to drill holes in metal or wood.

- a. It is important to know the parts of the cutting tip of the twist drill before sharpening.
  - 1) The two cutting lips of the drill perform the actual cutting.
  - 2) The heel is the outer, rounded edge of the drill bit.
  - 3) The dead center is the edge that separates the two cutting lips. The dead center must be exactly centered on the drill bit after it is sharpened.



- b. The two cutting lips are ground at an angle of 59 degrees to the center line of the drill shank.
  - c. The clearance of the twist drill is the difference between the heel and the edge of the cutting lip. The clearance should be 8 – 12 degrees. Too large a clearance will cause the cutting lips to break off. Too small a clearance will cause the drill to ride on the heel and the drill will not cut.
  - d. The procedure for sharpening a twist drill is as follows:
    - 1) Set the tool rest horizontal to the face of the grinding wheel.
    - 2) Hold the drill shank between the thumb and index finger. Rest the back of the index finger on the tool rest.
    - 3) Be sure that the cutting lip is straight across the face of the wheel at the beginning of each stroke. When the drill comes in contact with the wheel, push the drill shank downward and to the left at a slight angle. At the same time, rotate the drill a half turn so that the other lip is just visible.
    - 4) Repeat this process on the other lip to sharpen the entire twist drill.
    - 5) Check the cutting angle and clearance by using a template.
  - e. A hand jig can be used to sharpen drills when a grinder is not available. It is recommended that beginners practice with a hand jig.
4. Rotary mower blades can be sharpened to increase the effectiveness of a lawn mower or a field mower. Sharp blades do a faster, better looking mowing job and reduce the amount of damage to the plants.
- a. Only one side of the rotary blade is sharpened. Try to maintain the original angle of the cutting edge. If this cannot be determined, sharpen the blade to a 45 degree angle.
  - b. To maintain balance in the mower, the blade must be sharpened equally along its edge. A blade that is not sharpened evenly will rotate out of balance and cause the mower to vibrate. This creates wear on the engine, shaft, and body of the mower.
  - c. It is more desirable to use files rather than power grinders to sharpen blades. It is more difficult to properly position a blade edge on a grinder. Uneven grinding may occur which will cause the blade to rotate out of balance.
  - d. The first step in sharpening blades is to remove all nicks and chips from the cutting edge.
  - e. Clamp the blade into a machinist's vise and restore the edge using a large, flat file.

- f. Check the angle of the cutting edge frequently, using a sharpening template.
5. Shovels, hoes, and spades can be easily sharpened with grinders or files.
  - a. Shovels are always sharpened on the inside edge. Check other digging tools for the side on which they were previously sharpened.
  - b. Remove all excess metal, nicks, and chips from the cutting edge.
  - c. File or grind a new cutting edge into the tool. Spades and hoes should be sharpened to their original angle. If this is unknown, sharpen to a 20 to 30 degree angle.
6. Axes have a rounded metal side behind the cutting edge. This convex shape requires a special sharpening technique called convex grinding.
  - a. The blade of the axe should face up on the edge of the grinder. Use an up and down motion as the axe blade is drawn across the face of the grinding wheel. Stop the downward motion when sparks first appear to prevent the dubbing off of the axe blade.
  - b. The up and down motion should cover a distance of only 3/4" to 5/8" with each stroke.
  - c. A whetstone can be used to remove the wire edge created by the grinder and to put a fine cutting edge on the axe. Draw the blade across the stone at a 30 degree angle. Repeat this process on both sides of the blade.
7. Knives can be sharpened with either a whetstone or an electric grinder. Since there are often rules regarding the use of knives by students at school, the students should receive permission from the instructor before bringing their own knives to school for this exercise.
  - a. Only smooth-edged knives can be sharpened using this procedure. Serrated knives should be sent back to the manufacturer for sharpening.
  - b. Select a fine grit wheel since the knife blade is thin and often fragile.
  - c. Hold the knife with the cutting edge up and slowly move it back and forth across the grinding wheel. Do not apply much pressure to the knife as the blade may be damaged. Cool the blade in water often to prevent the blade from heating up.
  - d. Use an oilstone or a whetstone to put a fine cutting edge on the knife.
    - 1) Hold the knife flat to the stone with the back slightly raised.
    - 2) Draw the knife, edge first, across the stone; then flip the knife over and push it in the opposite direction.

- 3) Sharpening oil should be applied to the stone before sharpening to prevent damage to the stone and blade.
- 4) Properly clean the stone after using by wiping the excess oil from the face.

8. Scissors and shears each have two blades that must be sharpened.

- a. Only one side of the blade is sharpened. The shape of the edge is concave and the edge should have an angle of 80 degrees.
- b. Never sharpen the flat side of the blades. The strength of the metal is on this side.
- c. Grind all nicks and chips from the cutting edge.
- d. Grind to an 80 degree angle.
- e. Put a fine edge on the blade using a whetstone.

#### ACTIVITY:

1. Bring from home various tools that need to be sharpened. Permission should be obtained for some tools, such as knives.
2. Identify correctly and incorrectly sharpened tools.
3. Practice sharpening each of the tools listed in this lesson.

#### References:

Burke, Stanley R., & Wakeman, T. J. (1990). MODERN AGRICULTURAL MECHANICS (2nd ed.). Danville, IL: Interstate Publishers.

Cooper, Elmer L. (1997). AGRICULTURAL MECHANICS: FUNDAMENTALS AND APPLICATIONS, 3ed EDITION. Albany, NY: Delmar Publishers.

#### Special Materials and Equipment:

Examples of hand and bench grinders, rasps, files, and whetstones should be displayed. Slides, videos, films, and demonstrations concerning safe procedure of hand sharpening tools and grinders will be useful in this lesson.

#### \*\*\* NOTE TO INSTRUCTOR \*\*\*

Demonstrations should be valid and visual in order to demonstrate the true danger in the use of this equipment. Manuals, teacher guides, student workbooks and audiovisual materials concerning shop safety can be acquired from: American Association for Vocational Instructional Materials, 745 Gaines School Road, Athens, GA 30605. Telephone 1-800-228-4689.

Name \_\_\_\_\_

Date \_\_\_\_\_

Score \_\_\_\_\_

## UNIT EXAM, GRINDERS AND SHARPENING

Multiple Choice, Choose the best answer for the following questions.

1. \_\_\_\_\_ The lip clearance of a drill is between a \_\_\_\_\_ angle
  - a.  $5^{\circ} - 8^{\circ}$  angle
  - b.  $8^{\circ} - 12^{\circ}$  angle
  - c.  $12^{\circ} - 15^{\circ}$  angle
  - d.  $15^{\circ} - 20^{\circ}$  angle
2. \_\_\_\_\_ A 60 grit wheel is considered to be:
  - a. fine
  - b. medium
  - c. course
  - d. extra course
3. \_\_\_\_\_ Which type of grinding technique is used with a wood chisel?
  - a. hollow grinding
  - b. convex grinding
  - c. straight grinding
  - d. reverse grinding
4. \_\_\_\_\_ The center hole of a grinder wheel is called the:
  - a. axle bore
  - b. center hole
  - c. cylinder guide
  - d. arbor hole
5. \_\_\_\_\_ Which of the following is not a consideration when selecting a grinder wheel to fit a bench grinder:
  - a. arbor hole
  - b. diameter
  - c. width
  - d. strength

6. \_\_\_\_\_ A cold chisel is ground to which angle?
- a.  $60^{\circ} - 75^{\circ}$  angle
  - b.  $80^{\circ} - 85^{\circ}$  angle
  - c.  $80^{\circ} - 95^{\circ}$  angle
  - d.  $90^{\circ} - 95^{\circ}$  angle
7. \_\_\_\_\_ To put the finishing touches on a wood chisel to make it razor sharp, use a:
- a. grinder
  - b. pumice stone
  - c. whetstone
  - d. file
8. \_\_\_\_\_ The most correct device to use to check the angles on a tool is a:
- a. square
  - b. template
  - c. protractor
  - d. square angle
9. \_\_\_\_\_ The appearance of blue color on a tool you are sharpening indicates that the tip:
- a. is too hot
  - b. is too cold
  - c. is at the correct angle
  - d. should be ground more
10. \_\_\_\_\_ A grinder wheel should be discarded when it reaches \_\_\_\_\_ of its' original diameter.
- a.  $1/3$
  - b.  $1/4$
  - c.  $1/2$
  - d.  $2/3$
11. \_\_\_\_\_ A center punch tip is ground to a \_\_\_\_\_ degree angle.
- a.  $45^{\circ} - 60^{\circ}$  angle
  - b.  $60^{\circ} - 65^{\circ}$  angle
  - c.  $70^{\circ} - 75^{\circ}$  angle
  - d.  $80^{\circ} - 85^{\circ}$  angle

12. \_\_\_\_ The part of the drill bit that does the actual cutting is called the:
- a. cutting heel
  - b. cutting edge
  - c. cutting margin
  - d. cutting point
13. \_\_\_\_ Which of the following should NOT be worn while using a grinder:
- a. safety glasses
  - b. gloves
  - c. protective clothing
  - d. all of the above
14. \_\_\_\_ A groove in the center of a grinder wheel may be fixed by the use of a:
- a. wheel dresser
  - b. grinder
  - c. file
  - d. whetstone
15. \_\_\_\_ Which of the following is a soft metal that would “load” the wheel?
- a. brass
  - b. tool steel
  - c. high speed steel
  - d. cast iron
16. \_\_\_\_ The grit of a grinder wheel is determined by the:
- a. diameter
  - b. size of the abrasive particles
  - c. grinder make
  - d. material that may be ground
17. \_\_\_\_ When hollow grinding is desired, the tool is moved \_\_\_\_\_ on the wheel.
- a. up and down
  - b. side to side
  - c. diagonally
  - d. vertically
18. \_\_\_\_ If the cutting edges of a drill bit are not the same length, the hole will be:
- a. smaller
  - b. larger
  - c. oblong
  - d. tapered

Answer sheet, Unit Exam

1. A
2. B
3. A
4. D
5. D
6. A
7. C
8. C
9. A
10. A
11. B
12. B
13. B
14. A
15. B
16. B
17. B

## Tool Sharpening List

The following lists of tools are those which are to be sharpened by the student in order to complete the exercise for this lesson. Each student MUST sharpen one tool in sections A, B, and C. Tools in section D are exactly what they are, extra credit. No extra credit tools may not be substituted for required tools. Required tools must be completed before extra credit assignments are accepted.

### A. DRILL BIT

### B. CONVEX GRIND

SPLITTING MALL

AXE

HATCHET

### C. HOLLOW GRIND

WOOD CHISEL

COLD CHISEL

CENTER PUNCH

### D. EXTRA CREDIT

PIN PUNCH

DRIFT PUNCH

FIT A HANDLE ON A TOOL

\* POCKET KNIFE

\* ONLY LEGAL KNIVES AS PER OUR DISCUSSIONS ALREADY. ANY ILLEGAL KNIVES OR QUESTIONABLES WILL BE CONFISCATED. USE YOUR JUDGEMENT AND COMMON SENSE.



Name \_\_\_\_\_

Date \_\_\_\_\_

Tool Sharpening Score Sheet  
(75 Points)

## A. TWIST DRILL

correct lip angles \_\_\_\_\_

correct clearance angles \_\_\_\_\_

cutting lips the same length \_\_\_\_\_

workmanship \_\_\_\_\_

TOTAL POINTS \_\_\_\_\_

## B. CONVEX GRINDING EXERCISE

square on the tip \_\_\_\_\_

symmetrical on both sides \_\_\_\_\_

correct angle \_\_\_\_\_

correctly convex ground \_\_\_\_\_

workmanship \_\_\_\_\_

TOTAL POINTS \_\_\_\_\_

## C. HOLLOW GRINDING EXERCISE

square on the tip \_\_\_\_\_

correct angle \_\_\_\_\_

correctly hollow ground \_\_\_\_\_

whetstone finish \_\_\_\_\_

workmanship \_\_\_\_\_

TOTAL POINTS \_\_\_\_\_

ANY EXTRA CREDIT \_\_\_\_\_

GRAND TOTAL \_\_\_\_\_

## Grinding Wheels

Position	1	2	3	4	5	6
(Prefix)	Kind of Abrasive	Grain Size	Grade of Hardness	Structure	Bond Type	Manufacturer's Record
Example 32	A	46	H	8	V	BE
Manufacturer's symbol indicating exact kind of abrasive	A-Aluminum Oxide C-Silicon Carbide	course 10 12 14 15 20 24  medium 30 36 46 54 60  fine 70 80 90 100 120 150 180  very fine 220 240 280 320 400 500 600	Soft to Hard A soft B C D E F G H I J K L M N O P Q R S T U V W X Y Z hard	Dense to Open 1 dense 2 3 4 5 6 7 8 9 10 11 12 13 14 15 hard	V-Vitrified S-Silicate R-Rubber B-Resin E-Shellac O-Oxychloride	Manufacturers' private marking to identify wheel. May be a letter or number or both to designate modification of bond or wheel characteristics
(use is optional)				use is optional		(use is optional)

## SHARPENING A DRILL BIT

### STARTING POSITION

1. Hold the cutting end of the drill between thumb and forefinger of right hand with 1 inch of the drill bit exposed. Lay the forefinger on the grinder rest. The finger will be kept stationary and should not be lifted from the grinder rest during sharpening
2. Hold the shank of the drill between thumb and forefinger of the left hand.
3. The cutting edge of the drill should be parallel to the top of the grinder rest as in figure F-2.

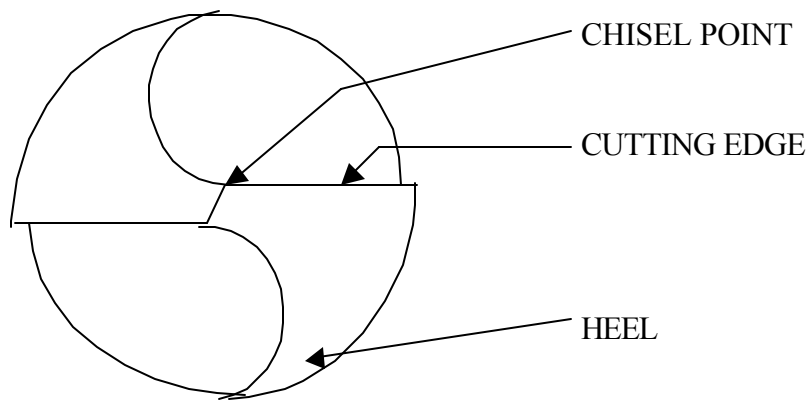


Figure F-1

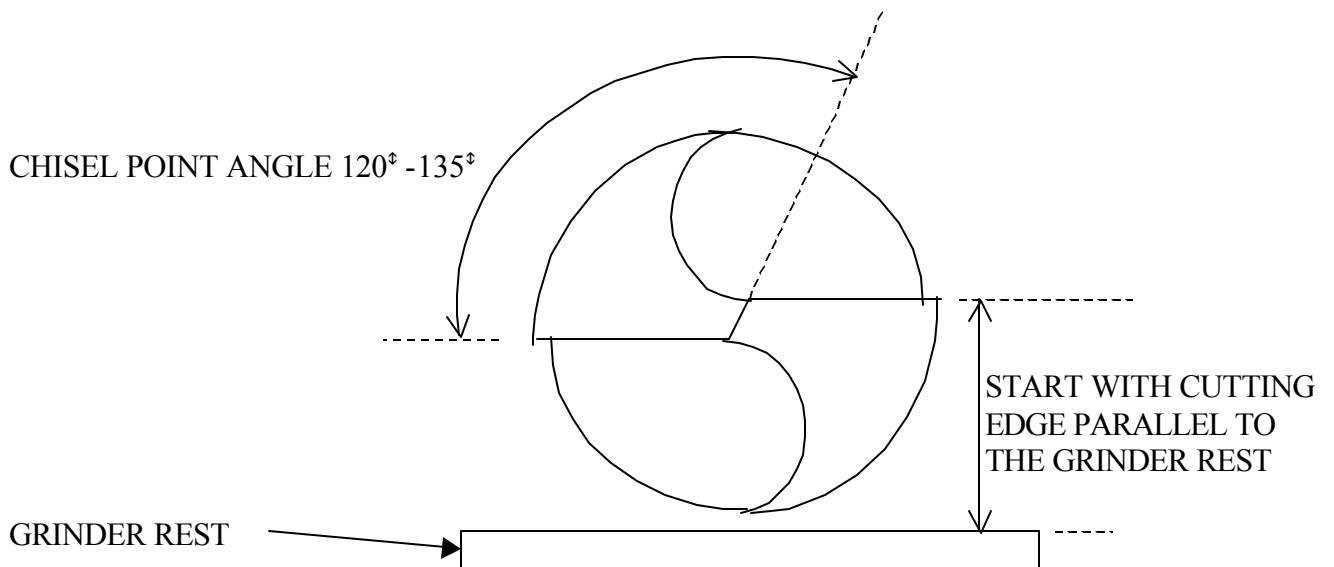
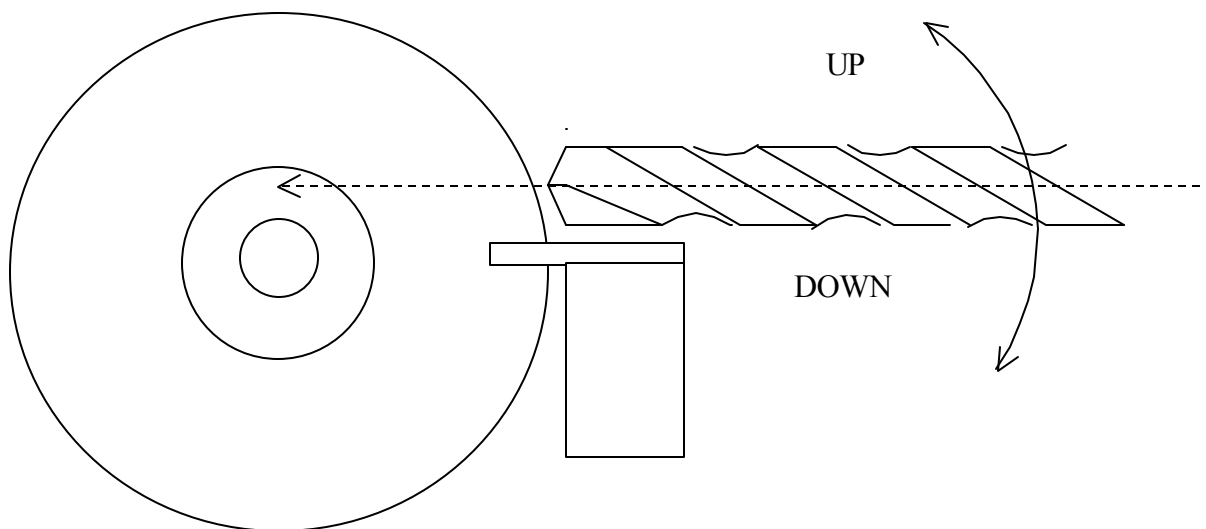
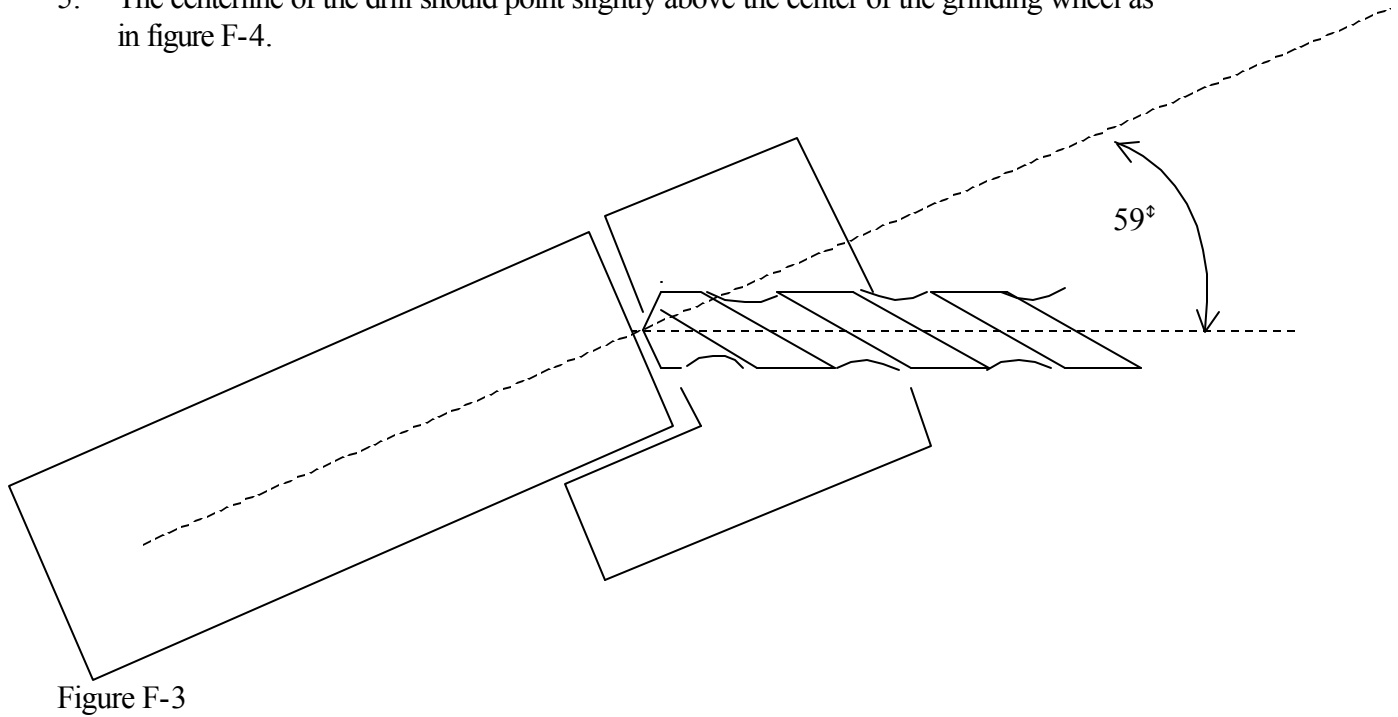


Figure F-2

4. The drill should be held at a  $59^\circ$  angle to the centerline of the grinding wheel as in figure F-3.
5. The centerline of the drill should point slightly above the center of the grinding wheel as in figure F-4.



## GRINDING THE DRILL

Move the drill to the stone and as the grinder makes contact, rotate the left thumb and forefinger down to the left. The knuckle of the left forefinger act as a pivot point and should not move up or down but it will rotate. The drill will rotate about  $1/6^{\text{th}}$  of a turn because of this motion. Do not rotate the drill between left thumb and forefinger as this would cause rotation of more than  $1/6^{\text{th}}$  of a turn and will cause an S-shaped chisel point. An S-shaped chisel point decreases the length of cutting edges and requires excessive pressure while drilling.

Repeat this grind, alternating between cutting edges, until the cutting edges are sharp, both cutting edges make a  $59^{\circ}$  angle with the axis of the drill, lengths of both cutting edges are equal, and there is an  $8^{\circ}$  to  $12^{\circ}$  lip clearance as in figure F-5. The chisel point should be straight and from a  $120^{\circ}$  to  $135^{\circ}$  angle with the cutting edges as in figure F-2.

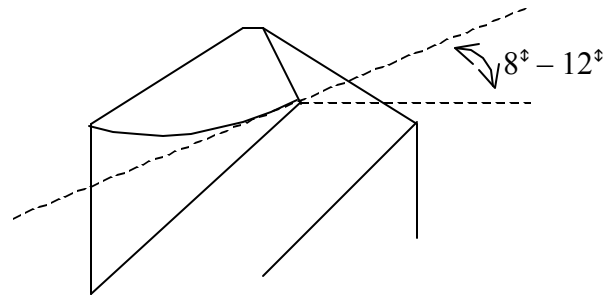


Figure F-5

## CORRECTING FAULTS OF TWIST DRILL SHARPENING

Faults	To Correct
Unequal length of cutting edges.-----	Grind short edge more.
Not enough lip clearance.-----	Move shank towards DOWN (Fig. F-4) at start of grind.
Too much lip clearance.-----	Move shank towards UP (Fig. F-4) at start of grind.
S-shaped chisel point.-----	Do not rotate drill as much.
No lip clearance at chisel point.-----	Not enough movement to left. (Fig. F-2)

## OTHER HINTS

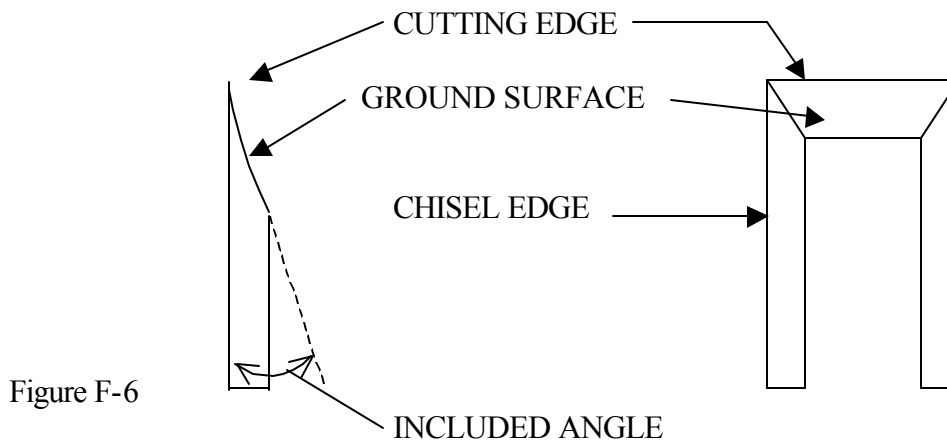
Use a bar of Ivory soap as a substitute for metal. Cutting the soap with a drill bit held in the hand will effectively demonstrate the proper cutting of a drill bit. It is difficult to remove even soft soap with a drill bit that lacks lip clearance.

Make sure grinder guards are in place while grinding.

## SHARPENING A WOOD CHISEL

### Steps in removing a wood chisel:

1. Remove the nicks and square the cutting edge to right angles with the sides or edges of the chisel
2. Grind the chisel to an included angle of  $25^{\circ}$  -  $30^{\circ}$  between the ground surface and the back of the chisel.
3. Hone the chisel to an included angle of  $30^{\circ}$  -  $35^{\circ}$  between the honed surface and the back of the chisel.



### Procedure in Sharpening a Wood Chisel

Step 1: Necessary only when the cutting edge is nicked. When this step is required the cutting edge is ground so as to remove the nicks and the cutting edge is ground to right angles with the edges of the chisel.

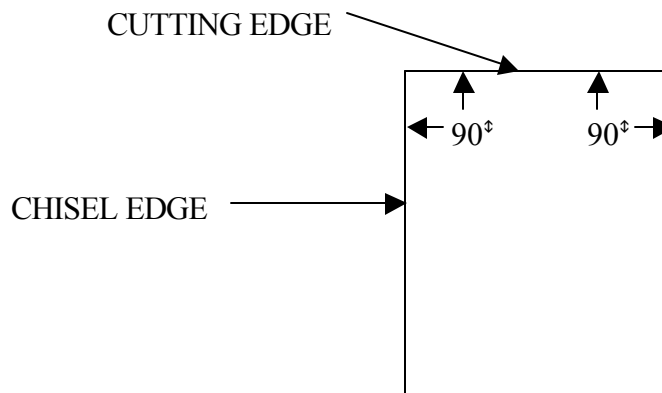


Figure F-7

Step 2: Grind the beveled surface so that the included angle will equal  $25^{\circ} - 30^{\circ}$ . This will be a suitable angle for most work although the angle may be decreased for light work and increased for heavy work such as with hardwoods.

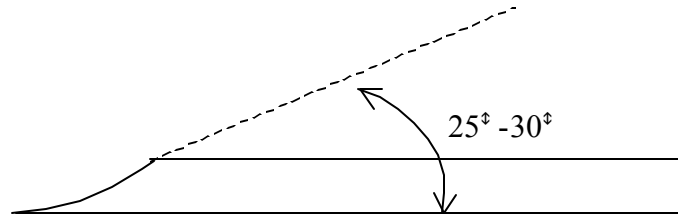


Figure F-8

Grinding on the face of the grinding wheel will result in the chisel being hollow ground. Keep the grinding wheel dressed so as to have a good cutting surface on the grinding wheel which causes a minimum of friction and prevents burning of the chisel.

Using the tool rest, grasp the chisel at a location on the chisel so that running the chisel on the tool rest and the forefinger against the tool rest edge will result in the proper angle being ground. Moving the grip towards the cutting edge will provide a greater included angle and moving the grip towards the handle will decrease the included angle.

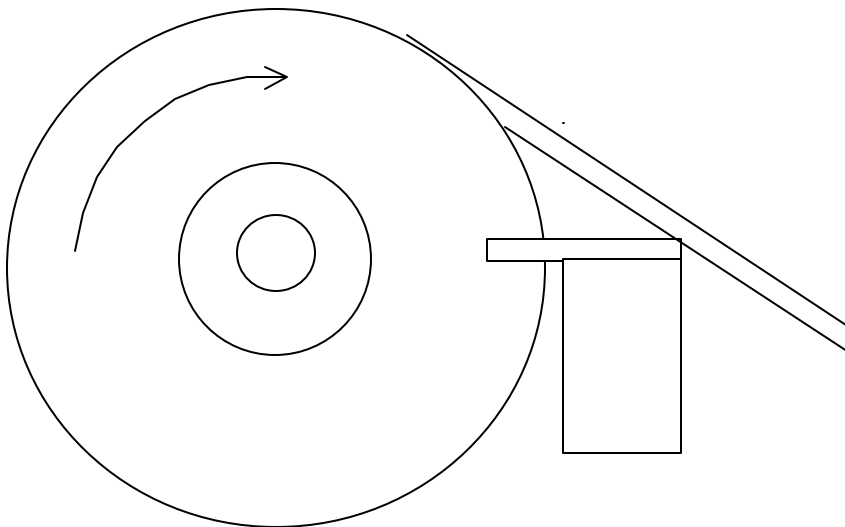


Figure F-9

An angle formed by the cutting edge and the right side of the chisel which is less than  $90^\circ$  is caused by the sharpener rotating the chisel counter-clockwise or swinging the handle to the right as in figure F-11.

An angle formed by the cutting edge and the left side of the chisel which is less than  $90^\circ$  is caused by the rotating the chisel clockwise or by swinging the chisel to the left as in figure F-12.

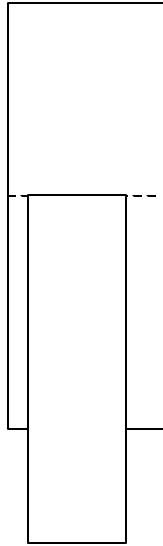


Figure F-10

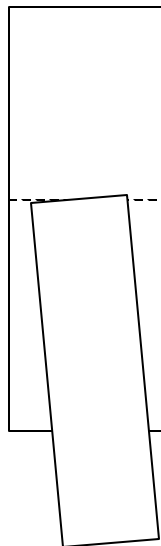


Figure F-11

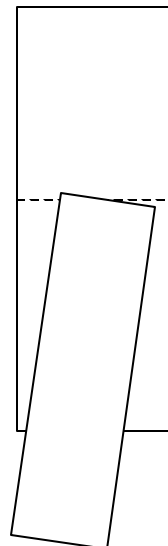
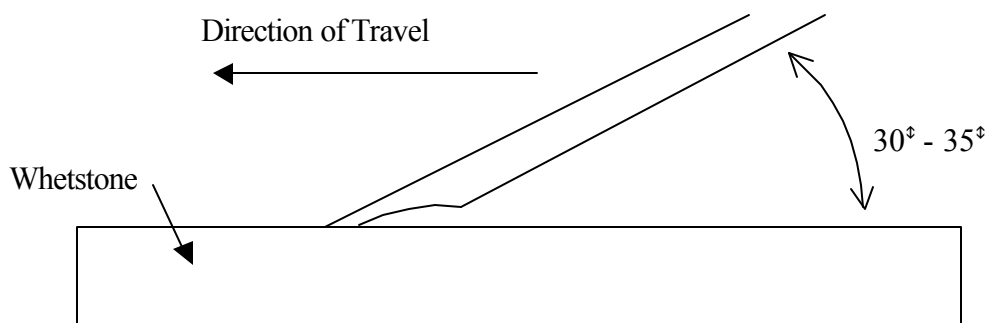


Figure F-12

Step 3: Hone the cutting edge to a  $30^\circ - 35^\circ$  included angle.

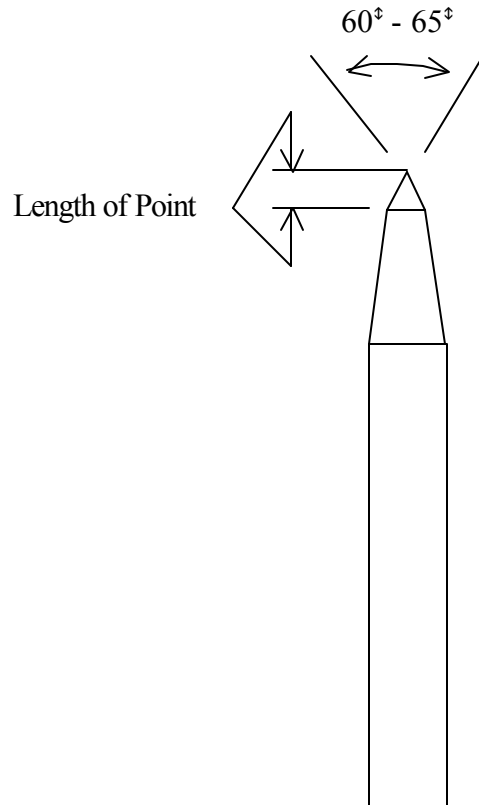


After taking 3 to 4 strokes on a fine stone check for a burr by drawing the pad of your finger over the cutting edge in the opposite direction of cutting. As honing progresses, a point is reached where the two surfaces of the cutting edge meet at a very fine line and become so thin that it starts to peel back and this causes the formation of a burr or wire edge. Place the flat side of the chisel on the stone and pull it toward you. One or two strokes should snap off the burr.



130F-25

## SHARPENING A CENTER PUNCH



### SPECSIFICATIONS

Single Face  
Face Hollow Ground  
60° - 65° Point  
Point to be Centered  
Length of Point Not to Exceed 1/4"

### Hint

Grind the same as you would a wood chisel.

HOLLOW GROUNG



CONVEX GROUND

